Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/449
HUNGARY
February 1964
Submitted in:
ENGLISH and RUSSIAN

Confidential until official release during Conference

Abstract

RADIOLYTICAL AND HEAT TRANSFER PROPERTIES OF SOME ORGANIC COOLANT-MODERATORS

I. Kiss and F. Szabó
Central Research Institute for Physics, Budapest, Hungary

Investigations performed in view of selecting the best types and the ways of improving the heat transfer properties of organics for reactor coolant-moderators are reported.

The organics investigated with above aim are of the hydrocarbon type. In the course of present work, among others, the most important physico-chemical features of the eutectic 28% diphenyl in diphenyl-methane mixture (D-DM) have been determined. The main attraction of this system for coolant-moderator purposes is its low melting point (13°C).

The static radiation tests were carried out in the 2 MW thermal VVRS-type nuclear reactor by irradiating samples in quartz ampoules. The radiation effects on D-DM (physical property changes, rates of gas evolution and polymerization, nature of the reaction products, etc.) were studied, in addition, in an in-pile circulating loop under similar to reactor operating conditions at various temperatures. The loop is actually a Field type tube and a canned rotor pump set-up installed vertically into the reactor core. About 8 litres of the coolant under investigation are circulated in the equipment with one litre within the reactor core. The liquid is brought to the desired temperature by an additional electric heating to the nuclear heating from the reactor. The total radiation energy input in the system was determined by calorimetry and the relative neutron dose rate was calculated from the measured values of the fast neutron flux by making use of the known energy spectrum. The thermal destruction rates were also determined.

Experiments on diphenyl-diphenyl-methane mixtures of various compositions did not reveal any appreciable energy transfer in the system.

The radiolytic decomposition rate for alkyl diphenyls was found to increase with the length of the alkyl side chain.

The experimental results show the D-DM mixture to be preferable to the polyphenyls owing to its low melting point and to be less sensitive to radiolysis than the mono-isopropyl-diphenyl.

Some thermophysical parameters of D-DM in a wide range of temperatures as well as the convective heat transfer coefficient of the system were also determined.

The convective and surface boiling transfer properties were studied on diphenyl, D-DM, and diphenyl-diphenyl-oxide systems. For these experiments the coolants were passed through a 0.5 mm long, 20 by 20 mm diameter tube containing the a.c. heated element made of stainless steel with 8 mm diameter. The effects of flow rate, subcooling and temperature (pressure) on surface boiling transfer were studied. The critical thermal load of the organic coolants under investigations was established at 260 - 400°C temperature, 1.5-6 m/sec velocity and for subcooling from 10 - 200°C.